Session 2 Overview

Bed Filters and Safeguard Devices

Session Chairs

John Hurley
Energy & Environmental Research Center
USA

Chikao Kanaoka
Kanazawa University
Japan

Although the use of ceramic filters for gas cleaning at high temperatures has made great strides over the last 20 years, a significant problem with the technology is occasional rapid pressure drop increases caused by low-permeability cakes. In addition, individual elements are still prone to rare but serious failures because dust can then travel downstream to damage other system components, such as power turbines, through erosion and corrosion. In this session, we address two technologies being developed to reduce the risks associated with filter failure. One technology is the development of failBsafe or safeguard devices employed downstream of the filters that prevent the dust from reaching the downstream systems in the case of filter failure. The other technology is the use of moving granular beds for dust collection. This type of system is not prone to the catastrophic failure that individual filters may experience, nor is it prone to rapid pressure drop increases in the case of impermeable cakes. There are a total of nine papers, five addressing filter fail-safe devices and four addressing bed type filters.

The papers concerning developments in filter failBsafe or safeguard devices describe two main types. One type is passive, employing a porous body that becomes plugged as dust enters when the upstream filter breaks. Four of the papers address this type, which must balance a desired low pressure drop against a required rapid plugging by the dust. One of the four employs a sticky coating to aid in rapid plugging. The fifth paper describes an active failBsafe system which physically moves upon breakage of the upstream filter to seal off the gas pathway.

In addition to the five papers addressing failBsafe devices, there are four intermixed papers describing development and testing of granular moving-bed filters. These filters are composed of slowly moving beds of rough, granular particles that provide a very high surface area for the dust particles to stick to as the dust-laden gas passes through the bed. The bed slowly moves through the gas pathway carrying the dust-laden granules out of the system, allowing them to be cleaned off-line then circulated back to the bed. Such filters are not prone to breakage or rapid pressure drop increases, but do have significant engineering challenges of their own. The presenters in this session describe some of those challenges, along with progress in finding solutions. The issues addressed include a method for reducing the formation of stagnant zones near the bed walls, measurements of flow patterns, the creation of a quasi-steady-state dust cake to reduce variations in filtration efficiency, a method for predicting the collection efficiency of the bed and pressure drop, and the development of operating data on a specific design of moving bed.